Section 7 Planned AIS Research Design

7.1 Research Design

The archaeological identification efforts described in this archaeological inventory survey plan (AISP) are archaeological research activities, and as such should be governed by a research design. A research design is essentially a plan that clearly identifies:

1) what is currently known about the research subject
2) the research objective or objectives
3) the research investigation steps and methods that will collect the needed information to fulfill the research objective
4) how the results of the investigation will be interpreted and evaluated

This research design was developed in consideration of what is currently known about the archaeological record in the vicinity of the Airport Phase 3 Section. It is also based on the specific engineering/construction requirements and footprint of the Airport Phase 3 portion of the Honolulu High-Capacity Transit Corridor Project (HHCTCP). Important considerations in the development of this research design are: 1) the Airport Phase 3 Section study area is completely developed and paved over; 2) there are unlikely to be surface indications of extant archaeological cultural resources; and relatedly, 3) all extant archaeological cultural resources are likely to be subsurface.

Construction Phase 3 of the HHCTCP is an area of relatively low archaeological sensitivity based on historic background research and the results of past archaeological investigations in the vicinity. As discussed in the Historic Background section, the intensity of land use within the vicinity of the project corridor was relatively low prior to historic agricultural enterprises and twentieth century development. As outlined in the Previous Archaeological Research section, archaeological investigations within the vicinity of the project corridor have been somewhat sparse, however, based on these prior investigations, the likelihood of significant subsurface archaeological deposits or human burials is considered to be low. The background research presented in the preceding chapters provides the historic/cultural information to make predictions regarding the types and locations of archaeological cultural resources that are likely within the study area. This background research, along with the detailed preliminary engineering information that delineates the actual project footprint, was used to develop the project's research design, including methods and sampling strategy.

The overall objective of the archaeological cultural resource identification activities described in this AISP is to locate and document archaeological cultural resources that may be affected by the HHCTCP Airport Phase 3 Section construction. The Airport Phase 3 Section AIS will be carried out as part of the HHCTCP's compliance with State and Federal historic preservation requirements. It will identify archaeological deposits, including human burials, within the Phase 3 corridor. Once identified these archaeological deposits will be investigated and recorded in sufficient detail so that their significance can be assessed and the Project's potential effect on significant archaeological deposits can be evaluated. Only then can appropriate mitigation decisions be made.

This AISP focuses exclusively on archaeological cultural resources; the identification, documentation, and treatment decisions for traditional cultural properties (TCP) and historic buildings and structures are not part of the current investigation. This is not to say that the resulting AIS report for the Phase 3 Airport will not utilize the information currently being generated as part of the City's on-going TCP and historic landscape studies.

The City is currently working with the SRI Foundation and Kumu Pono Associates to produce a comprehensive ethnographic and ethnohistoric investigation of the HHCTCP project corridor and its environs. These investigations, including historic research with Hawaiian language sources, place name and oral tradition research, and ethnographic interviews, will support and be incorporated into the project's TCP study. Additionally, the City is working with Mason Architects to produce historic context studies and cultural landscape reports for the HHCTCP corridor. As information is generated from these ongoing TCP and historic context and landscape studies, it will be utilized to augment and inform the interpretations and recommendations of the ongoing Airport Phase 3 Section AIS research. This additional background will further augment the archaeological/cultural context that is required to appropriately evaluate the significance of the archaeological cultural resources that are identified during the Airport Phase 3 Section AIS.

Although this AISP precedes the actual AIS fieldwork, the research activities related to the Airport Phase 3 Section AIS have already begun. For example, extensive cultural consultation with Native Hawaiian Organizations (NHOs) and individuals is already underway as part of the preparation of this plan (refer to Section 7, below). Additionally, AIS research methods investigations (described below in this section) were carried out to inform this research design. The proposed research strategy includes the following roughly sequential steps:

AISP Preparation:

1. Conduct environmental, cultural, historical, and archaeological background research
2. Development of an archaeological predictive model/summary of past finds based on background research
3. Carry out methods investigations to evaluate appropriateness of potential investigation methods/techniques
4. Overlay the project's preliminary engineering plans on the predictive model
5. Develop a preliminary subsurface sampling strategy based on the overlay
6. Consult with NHOs, community members, project engineers, and the City regarding the proposed AIS methods and subsurface sampling strategy
7. Modify sampling strategy based on consultation comments
8. Prepare draft AISP for the SHPD and community review and comment
9. Prepare final AISP for SHPD approval based on comments received

AIS Fieldwork and Laboratory Work:

10. Implement field survey/sampling strategy

11. Augment/modify sampling strategy as needed to provide required cultural resource documentation and to facilitate avoidance of identified cultural resources
12. Process collected samples and conduct laboratory studies on selected materials as the AIS fieldwork continues

AIS Report Preparation and Consultation:

13. Through the PA's consultation protocol regarding treatment of any *iwi kūpuna* (burials/human skeletal remains) identified during the AIS fieldwork (PA Stipulation III.B.4)—disseminate information to cultural descendants and interested parties to facilitate burial treatment decisions
14. Incorporate the results of the ongoing TCP and historic context and landscape studies into the write-up and interpretation of the AIS-identified archaeological cultural resources
15. Coordinate with Mason Architects, Kumu Pono Associates, and the SRI Foundation so that documentation from the on-going AIS investigation is available to be incorporated into the ongoing TCP and historic context and landscape studies
16. Consult with NHOs, community members, interested individuals, and the City regarding the AIS results, including cultural resource significance, project effect, and mitigation recommendations
17. Prepare draft AIS report for SHPD and community review
18. Prepare final AIS report based on review comments received
19. Disseminate copies of the final AIS report to interested consulting parties, the City, and per the requirements of HAR Chapter 275-5(e)(3) (with copies submitted to SHPD, University of Hawai'i at Mānoa's Hamilton Library Pacific Collection, Bishop Museum Library, University of Hawai'i Hilo Library, Maui Community College Library, and the Kaua'i Community College Library)

The approach, methods, and sampling strategy, to conduct the Phase 3 AIS are outlined in the remainder of this AISP. This plan will be submitted to the SHPD for review and approval prior to the commencement of the AIS investigation.

7.2 Research Focus

Where possible, archaeological research designs should include specific research questions that can be answered by the proposed research. With inventory/identification-type investigations such as the Airport AIS, however, conducting research to answer specific research questions is usually not appropriate.

The development of specific archaeological research questions should be based on review of existing contextual themes (cultural/historic contexts), a synthesis of pertinent prior research results, and a relatively detailed understanding of the types of information available from the archaeological site or sites to be investigated. Based on a synthesis of this information, specific research questions that can inform on the site's or sites' contextual theme(s) are identified. Research methods are outlined and justified that will adequately gather from the site or sites the specific classes of data required to investigate the proposed research questions. Appropriate

analytic methods are described that will turn field observations and analytic results into meaningful evidence in terms of answering the stated research questions.

This AISP describes an archaeological inventory survey investigation. The purpose is to identify archaeological cultural resources in the project APE, then document them sufficiently so that their significance can be assessed and the project's effect on these cultural resources can be evaluated. Although portions of the AIS study area have been previously studied, the vast majority of the study area has yet to be inventoried for archaeological resources. For the current AIS investigation, we simply do not have the necessary information regarding the archaeological resources in the APE to formulate specific archaeological research questions. Conducting the AIS research to address specific research questions would require assumptions regarding the types of data classes that are present within the APE. Formal research questions would transform what should be an identification phase investigation into a data recovery or mitigation phase investigation.

Accordingly, the AIS will not address specific research questions. Instead it will have a broader, more general research focus. Based on the background research conducted as part of this AISP, this AIS investigation has the potential to inform on a wide range of archaeological topics, several of which are briefly summarized below:

1. Settlement Transect—The proposed AIS investigation is an opportunity to identify and document archaeological resources within a narrow but continuous transect through modern O‘ahu's densely developed coastal south shore. The results of the AIS investigation will likely inform on differences in the distribution of pre-contact human settlement and activity across this broad area. Change related to post-contact Western acculturation may be apparent in the distribution of archaeological site and feature types.
2. Ground Penetrating Radar (GPR) Utility—In general, GPR's use in archaeological research has become fairly well established over the last decade. In Hawai‘i, the technology has been somewhat slower to be utilized. The AIS investigation will provide a means to evaluate the GPR method's strengths and weaknesses in terms of archaeological research, particularly in fully developed urban landscapes.
3. Pre-Contact Landforms and Shorelines—The coastal location of the Airport Phase 3 portion of the HHCTCP has been subjected to intensive modification throughout the post-contact period. The AIS investigation will provide direct data on pre- and post-contact change to the landforms and shorelines. Potential AIS data collection could include the pre-contact cultural landscape of shoreline fishponds, *lo‘i (*irrigated pond fields), and houselots, and the expansion of post-contact fill lands for residential and commercial usage.
4. Human-Induced Environmental Change—Research into diachronic human-induced environmental change within the Airport Phase 3 portion of the HHCTCP would be augmented by the results of such research methods as pollen analysis, wood taxa identification, and Carbon 14 analysis.
5. Burials—One of the primary foci of the proposed AIS investigation will be the identification of burials (*iwi kūpuna*). The AIS would inform on distribution, age (pre- vs. post-contact), and burial practices over time. Additionally, the AIS research would allow for evaluation of remote sensing methods, such as GPR, specific to burial finds.

7.3 Environmental and Cultural/Historical/Archaeological Background Research

Background research for this AISP included, and additional research for the preparation of the AIS report will include: a review of previous archaeological studies on file at the SHPD; review of documents at Hamilton Library of the University of Hawai‘i, the Hawai‘i State Archives, the Mission Houses Museum Library, the Hawai‘i Public Library, and the Archives of the Bishop Museum; study of historic photographs at the Hawai‘i State Archives and the Archives of the Bishop Museum; and study of historic maps at the Survey Office of the Department of Land and Natural Resources. Historic maps and photographs from the CSH library were also consulted. In addition, Māhele records were examined from the *Waihona ‘Aina* database (<www.waihona.com>). LCA and Royal Patent records for the land areas immediately along the Airport Phase 3 Section corridor were copied from *Waihona ‘Aina* and the Hawai‘i State Archives; these records are included in Appendices A through E.

This research provided the environmental, cultural, historic, and archaeological background for the study area. The sources studied were used to formulate a predictive model regarding the expected types and locations of cultural resources in the project area.

7.4 Methods Investigation as Part of AISP Preparation: GPR Technology

As part of the AISP preparation, CSH investigated the efficacy and cost benefit of a suite of different ground penetrating radar (GPR) antennae and techniques for the identification of human burial remains and other types of subsurface archaeological features. A summary of the investigation and its results is provided below.

7.4.1 GPR Methods Investigation

In 2010, at the request of CSH, TAG Research by Sturm, Inc. conducted a GPR methods investigation within select areas of Honolulu to test this remote sensing technology’s efficacy in the identification and mapping of subsurface cultural deposits, including human burials (see Sturm 2010). This investigation sought to evaluate which antenna frequencies (270 MHz, 400 MHz, or 900 MHz), data collection parameters, and data processing procedures would be the most effective for potentially identifying and mapping subsurface cultural deposits within an urban setting dominated by extensive subsurface modifications including backfilled excavations, utility lines, and land filling.

GPR surveys were conducted at six locations: the ATC/JTMC, St. Augustine-by-the-Sea Church, a portion of Halekauwila Street, the proposed location of the Civic Center Station, and two discrete areas at the Kaka‘ako Fire Station (Figure 51). The GPR survey areas within the proposed location of the Civic Center Station and Halekauwila Street are both situated within the project corridor. The remaining four survey areas had been previously investigated via subsurface testing and/or archaeological monitoring by CSH (Pammer et al. 2009; Pfeffer et al. 1993; Yucha et al. 2011). During these prior archaeological investigations, subsurface cultural deposits, including human burials, were identified within stratigraphic contexts that are similar to those that are anticipated to be present within the project corridor. Thus, the four survey areas located outside the project corridor were investigated in an attempt to model how subsurface

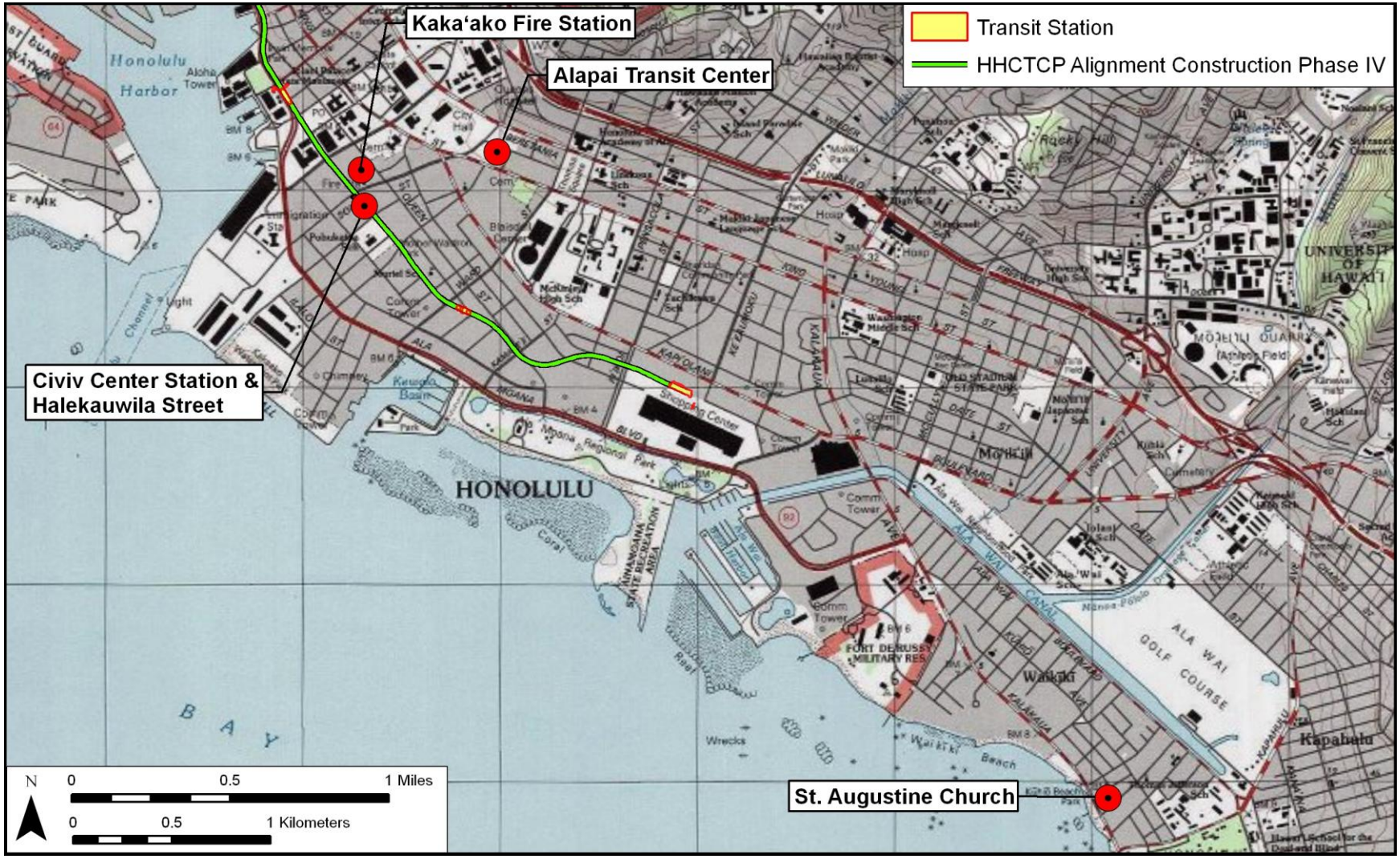

Figure 51. U.S. Geological Survey 7.5-Minute Series Topographic Map, Honolulu (1998) Quadrangle, showing the locations of GPR survey areas

cultural deposits, including human burials, are recorded via GPR and then apply these models to GPR data collected within the project corridor. The results would address the efficacy of using GPR to identify the presence of subsurface cultural deposits, including human burials, prior to subsurface testing.

The results of the GPR methods investigation were promising, although with some constrictions and limitations. TAG Research was able to confirm the locations of known human burials within all of the survey areas in which burials were previously recorded. Burial pits were represented in GPR depth profiles as ephemeral hyperbolic reflections. These hyperbolic reflections were associated with stratigraphic irregularities caused by burial pit excavation (i.e., burial shafts and associated backfill material) rather than by the burials themselves (Sturm 2010), which was likely due to a number of factors, including the sediment mineralogy and deterioration of the burial and/or casket, if one was present. The hyperbolic reflections corresponding to the known locations of previously recorded burials were the only GPR anomalies that could be confidently determined to be associated with human burials.

Other subsurface features that were able to be identified and mapped via GPR were fill deposits and utility lines. In general, both of these features were represented in GPR imagery (i.e., depth profiles and amplitude slice maps) as high amplitude reflections of large size. Anomalies associated with utility lines were linear and tended to be narrower than the large amorphous masses associated with fill deposits.

These results led to the determination that "the overall potential for using the GPR method to map archaeological features and burials in this urban Honolulu setting is considered very good up to about 1.5 meters in depth" (Sturm 2010:35). Of note, however, were several limitations, including the inadequate resolution of GPR readings below 1.5 meters and the fact that the association of subsurface anomalies with possible burials could only be accomplished with confidence in areas where burials have already been confirmed to be present (i.e., through previous archaeological subsurface testing or historic land use research).

One of the goals of this method investigation was to address the question of depth penetration and resolution in relation to various GPR antenna frequencies (270 MHz, 400 MHz, and 900 MHz). Based on the results of the GPR surveys, the 400 MHz antenna was determined to provide the best overall quality data, allowing high resolution mapping of target features of interest (including burials) to a depth of approximately 1 to 1.5 meters. While the 270 MHz antenna achieved the overall greatest depth at each location surveyed, it was unable to provide adequate resolution to target features of interest, including burials. Conversely, the 900 MHz antenna provided the best resolution of subsurface features but was limited to an average depth penetration of half a meter, which in a majority of Honolulu is a stratigraphic zone dominated by imported fill deposits.

Recommended data collection parameters for conducting future GPR surveys within the project corridor include conducting surveys within wider areas or blocks, as opposed to single narrow transects, using a transect spacing of 50 centimeters (cm) or less, and having a high number of scans per meter (e.g., 40). All of these factors will ensure the collection of high-resolution data and subsequent mapping of potential archaeological features of interest, which are typically small or subtle and could be easily missed by using wide transect spacing or coarser resolution collection (Sturm 2010:36).

Recommended GPR data post-processing involves the creation of GPR reflection profiles and amplitude slice maps for the analysis of collected data. Reflection profiles illustrate the shape, geometry, and depth of the radar reflections recorded during data collection. An analysis of these profiles can determine whether radar energy is reflecting from a flat stratigraphic layer (seen as a distinct horizontal band), a discrete buried object (seen as a hyperbola), or from stratigraphic irregularities such as subsurface disturbances associated with utility installation or human interment (also seen as hyperbolas, but usually are more ephemeral and consist of clustered reflections).

Amplitude slice maps are a three-dimensional tool for viewing differences in radar reflection amplitudes across a given surface at various depths. Amplitude slice maps can be thought of as plan view maps or excavation level records that display GPR data at user-defined depth intervals. Reflected radar amplitudes are of interest because they measure the degree of physical and chemical differences in buried materials, which in turn can indicate the presence of stratigraphic interfaces, discrete buried objects (e.g., basalt boulders, utility lines, burial caskets, etc.), or stratigraphic irregularities (i.e., subsurface anomalies associated with burial pits, fire pits, buried irrigation ditches, etc.). Amplitude slice maps are important because they allow the visulization of radar reflections throughout the entire dataset collected at a survey area at a given depth. This gives size and shape to collected radar reflections, which can aid in the interpretation of identified subsurface anomalies.

Finally, while this GPR methods investigation was successful at mapping many features of interest, including several previously recorded burials, many of the feature interpretations were based on knowledge gained from previous archaeological investigations that involved extensive background research and subsurface testing. It is thus recommended that future GPR surveys be correlated with site-specific historic research and subsurface testing (i.e., excavation) wherever possible (Sturm 2010:29, 36). A detailed report of the findings of the GPR methods investigation can be found in Appendix D.

7.5 Consultation

CSH has contacted a wide range of state agencies, Native Hawaiian Organizations, lineal and cultural descendants, and other interested individuals and groups in order to identify potentially knowledgeable individuals with cultural expertise and/or knowledge of the study area and the surrounding vicinity. Organizations consulted include the SHPD/DLNR, the Office of Hawaiian Affairs (OHA), and the O‘ahu Island Burial Council (OIBC). In accordance with Stipulation III of the HHCTCP Programmatic Agreement, CSH pursued consultation in order to gain input and comment on the scope and design of the Airport Phase 3 Section Archaeological Inventory Survey Plan and in order to create a draft protocol for consultation regarding the treatment of any *iwi kūpuna* identified during the AIS.

7.6 Field Methods

In general, fieldwork will include 100 percent pedestrian inspection of the study area; global positioning system (GPS) data collection; GPR survey; and subsurface testing. All areas selected for subsurface testing will be surveyed with a Geophysical Survey Systems, Inc. SIR-3000 GPR unit equipped with a 400 MHz antenna. The planned subsurface testing program will be backhoe-assisted. In general, linear trenches measuring approximately 3 m or 6 m (10 feet or 20

feet) long and 0.6 or 0.9 m (2 feet or 3 feet) wide will be excavated within the project footprint (based on preliminary engineering) at selected station locations, guideway column locations and utility relocation areas. Forty (40) test excavations are proposed, with the potential for additional testing to refine the boundaries of subsurface deposits.

7.6.1 Personnel and Scheduling

Airport Phase 3 Section AIS fieldwork will proceed under the direction of CSH principal investigators Matt McDermott, M.A., and Hallett H. Hammatt, Ph.D. An anticipated field crew of eight to ten archaeologists, including one field director, two GPS/GIS specialists, and two GPR specialists, will complete the AIS investigation under the direction of the principal investigators. It is estimated to take two to three months to complete AIS fieldwork. This work will likely be carried out between fall 2011 and spring 2012.

7.6.2 Pedestrian Survey

Pedestrian inspection of the study area will be completed at 100 percent coverage. The pedestrian inspection will generally be accomplished through systematic sweeps. As the study area is generally located in the median or shoulder of existing roadways, archaeologists will likely traverse the medians and shoulders of the active thoroughfare. The pedestrian inspection will include identification and documentation of surface archaeological cultural resources. Identification and documentation of the project area's architectural cultural resources, including historic roads, bridges, and structures, was conducted by historic architectural firm Mason Architects, Inc., in association with the project's Environmental Impact Statement (EIS) (USDOT/FTA and C&C/DTS 2008).

All archaeological cultural resources encountered will be recorded and documented with a written field description, scale drawings, and photographs, and will be located using a Trimble ProXH mapping-grade GPS unit (sub-foot accuracy). Cultural resource descriptions will include evaluations of age, function, interrelationships, and significance. All cultural resources will be assigned State Inventory of Historic Properties (SIHP) numbers.

7.6.3 GPR Survey

All areas selected for subsurface testing will be surveyed with GPR prior to excavation. GPR field data will be post processed and used to inform the subsurface testing results. The GPR survey will be performed using a Geophysical Survey Systems, Inc. (GSSI) SIR-3000 system equipped with a 400 MHz antenna. This is a bistatic system in which electromagnetic energy in the radar frequency range is transmitted into the ground via a sending antenna. Radar energy is reflected off of the subsurface matrix and is then received by a paired antenna. Reflected energy is sampled and the travel time (in nanoseconds) of the reflected waves is recorded. Wave propagation speed varies depending on the nature of the subsurface medium. Any changes in density or electromagnetic properties within the stratigraphic column may cause observable variations in reflection intensity. Reflection features may include discrete objects, stratigraphic layering, or other subsurface anomalies.

The GPR survey will be conducted in blocks centered on the subsurface testing area. The GPR will generate two-dimensional (2D) depth profiles in order to prospect for subsurface anomalies and stratigraphic interfaces prior to excavation, as these could correspond to isolated

archaeological features or sediments that are more likely to contain cultural deposits. Following the completion of subsurface testing, the documented stratigraphy will be referenced against the GPR profiles to establish if there were patterns in the GPR data that may be associated with stratigraphic interfaces, sediment types, and subsurface features (e.g., trash pits, construction debris).

The GPR survey will also be conducted to assess the ability of GPR in determining stratigraphy and locating cultural deposits in the study area (i.e., urban Honolulu). The effectiveness of GPR is highly dependent on local soil conditions. The high signal attenuation rate of many soil types restricts the depth of radar penetration and therefore limits the effectiveness of GPR surveys. The National Resource Conservation Service (NRCS) produced maps indicating the relative suitability of GPR applications throughout the U.S. based on U.S. Department of Agriculture (USDA) soil survey data. Figure 52 shows the study area on the NRCS GPR Suitability Map for Hawai‘i. The project area is shown to traverse lands in the moderate (“# 3”) and very low (“# 5”) suitability categories.

7.6.4 Excavation Methods

The planned subsurface testing program will be backhoe-assisted. In general, linear trenches measuring approximately 3 m or 6 m (10 feet or 20 feet) in length and 0.6 or 0.9 m (2 feet or 3 feet) in width will be excavated within the project footprint (based on preliminary engineering) at selected station locations, guideway column locations, and utility relocation areas. To the extent feasible, test trenches will be excavated at the precise location of the proposed guideway column foundations/utility relocation areas, as currently shown on the Project’s preliminary engineering plans; however, it is clear that considerable conflicts exist between the proposed AIS testing locations and existing subsurface utilities. In cases where subsurface testing at the precise location of the proposed guideway column foundation/utility relocation area is prohibitively problematic due to existing subsurface utilities or other constraints, an alternate test area may be selected, or the test excavation may be slightly offset from the column foundation location. Excavations will be made to depths of culturally sterile sediments, bedrock, or just below the water table (excepting where safety concerns come into play).

The testing program also will focus on characterizing the remnants of the project area’s buried natural land surface that predates the historic and modern fill layers. These remnants of the former land surface are more likely to be associated with significant cultural deposits.

CSH personnel will closely monitor all backhoe excavation activity. Archaeologists will watch as the backhoe excavates at a normal pace, as well as inspect the sediment as it is removed from the ground and dumped into a backfill pile adjacent to the excavated trench. A standard backhoe with a 2-foot-wide bucket will be used to excavate, at a minimum, portions of each trench. The excavation will extend through the fill layers to any underlying natural sand deposits (i.e., naturally-deposited sand layers, not imported land reclamation or construction fill layers). If natural sand deposits are discovered, excavation will continue by hand until culturally-sterile sediments are reached, or to the depth of the water table. During hand excavation, the sand will be carefully scraped off in thin layers in order to reduce disturbance to possible cultural deposits or human burials. During hand excavation through sand deposits, the backhoe may be used to assist with the removal of already hand excavated sediments from the trench. For example, if the archaeologists throw the hand-excavated sand into one corner of the trench, the backhoe may be

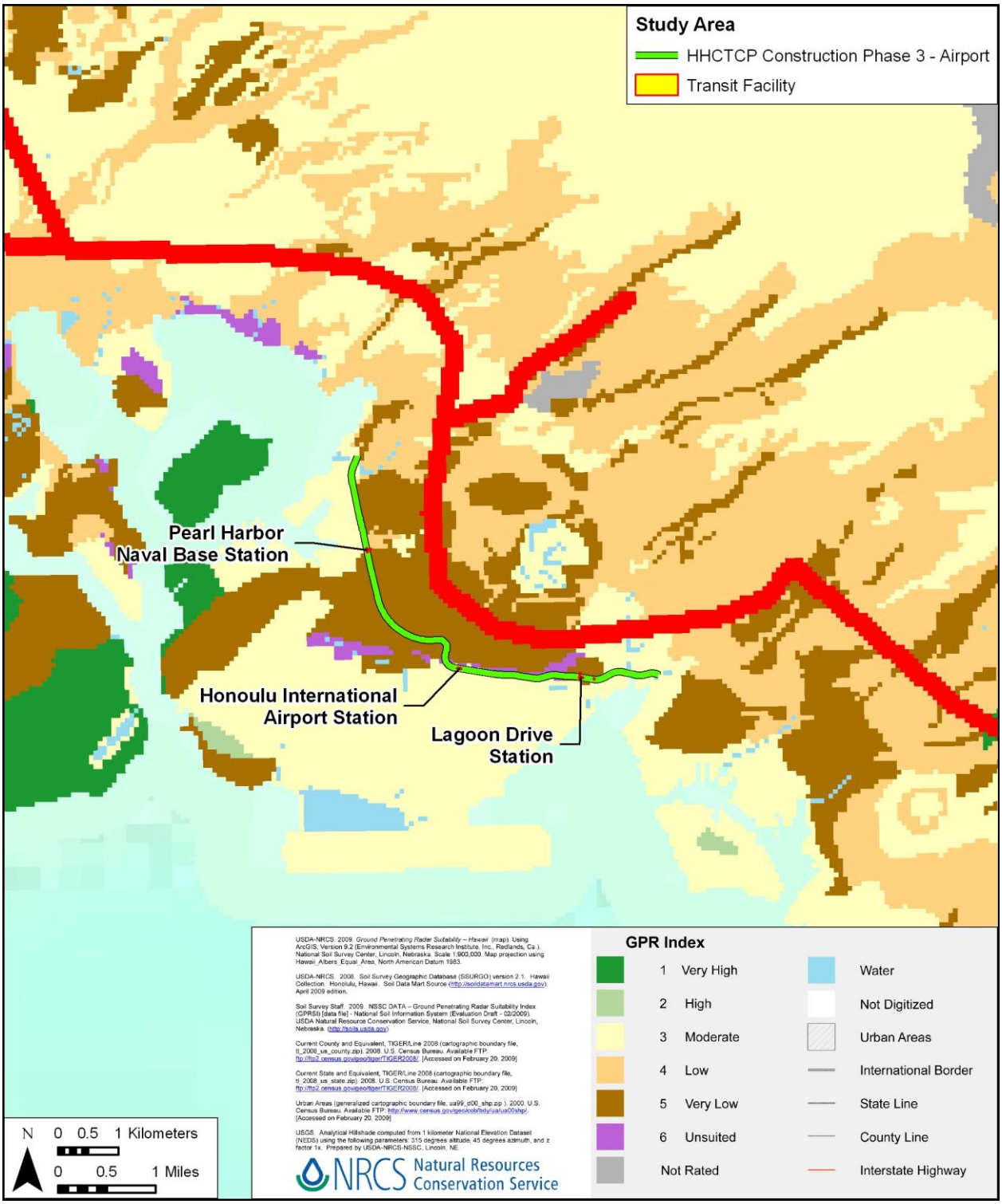

Figure 52. NRCS GPR Suitability Map for Hawai‘i showing the study area

used to remove this already excavated sand from the trench.

Each test excavation will be documented with a scale section profile, photographs, and sediment descriptions, and located using a Trimble ProXH mapping-grade GPS unit (sub-foot accuracy). Sediment descriptions, using standard USDA soil description observations/ terminology, will include: Munsell color designations; texture; consistency; structure; plasticity; cementation; origin of sediments; descriptions of any inclusions, such as cultural material and/or roots; lower boundary distinctiveness and topography; and other general observations.

If human skeletal remains are encountered during subsurface testing, no further work will take place in the vicinity of the find, including no screening of back dirt, no cleaning and/or excavation of the burial area, and no exploratory work of any kind, unless specifically requested by the SHPD/DLNR. All human skeletal remains that are encountered during the AIS fieldwork will be handled in compliance with HRS Chapter 6E-43 and HAR Chapter 13-300 and in consultation with the SHPD/DLNR. A burial consultation protocol, currently undergoing drafting and consultation, shall further refine the processes and protocols that will be implemented in the event of the identification of human skeletal remains.

7.6.5 Sampling

Sampling of subsurface cultural layers and/or A horizons will be carried out to characterize the cultural content of these layers. Sampling also will help to establish the spatial extentof the layers and the general time frame of their deposition (prehistoric/traditional Hawaiian and/or historic and/or modern). The sampling will be undertaken on both pit features associated with the stratigraphic layer and sample areas taken from the portion of the stratigraphic layer that was not part of a particular cultural feature. The distinction between samples from pit features and samples from sample areas will reflect the difference in cultural material content between sediment from specific events, such as the excavation and use of a pit, and the more general accumulation of sediment as part of a culturally-enriched stratigraphic layer.

The samples from pit features and sample areas will be excavated out of the sidewall or from the base of the excavation into 5 gallon buckets. The sediment then will be screened through 1/8-inch wire mesh and all cultural materials will be collected, bagged by provenience, and taken to the CSH laboratory. During the collection of cultural materials from the screen, careful attention will be made to distinguish between water-rounded, bleached, natural marine, sedimentary shell, and the unbleached, un-rounded, often relatively freshly-broken shell derived from human activity. The volume of each screened sample will be recorded so that comparisons can be made between samples.

Where appropriate, column sediment samples of discrete strata, or series of strata, will be taken directly from the cleaned sidewall of the trench. Depending on the type of sediment to be sampled and the analytic purpose of the column samples to be collected, column samples will be collected in 5, 10, or 20 cm depth intervals. For example, column samples from low energy alluvial sediments that may inform on environmental conditions and environmental change will be collected at 5 cm intervals. These samples could be used for radiocarbon dating, pollen analysis, and micro charcoal particle quantification.

Where additional documentation of a particular sediment is desired, bulk sediment samples of 1 to 5 liters will be collected from the cleaned sidewall of the trench for further analysis in the laboratory. These samples can be used to better characterize a sediment and for further analysis, including wet screening through 1/16-inch mesh to better inspect the sediment's contents. All sediment sample collection locations will be recorded on trench profiles and the sediment samples will be labeled with provenience information.

Background research indicates the possibility of encountering historic trash pits, privies, and other historic pit features in the AIS trenches. These types of historic features typically contain substantial numbers of individual artifacts, ranging from building materials, metal fragments, household refuse, and industrial refuse. Artifact material types include brick, stone, wood, glass, metal, ceramic, bone, and plastic. Documentation of these historic, generally artifact-rich, features will focus on recording these features' dimensions and locations so that their distribution can be considered in relation to historic land use of the study area. Recordation of these features will focus on collecting sufficient information to characterize the features' age, and possibly the feature's duration of use, and to characterize the feature's function (e.g., residential versus commercial or industrial refuse disposal). Much of the artifact documentation, for example with redundant bottle types, faunal remains, etc., will be done in the field with photographs, written descriptions, and detailed quantification. The collection of historic artifacts will be limited to diagnostic and/or interpretive items, or items that cannot be readily identified in the field that will require further analysis in the laboratory. Large numbers of redundant diagnostic historic artifacts from the same features will be documented with photographs and written descriptions and systematically quantified in the field, but will not be collected. Non-diagnostic glass, metal, wood, stone, plastic, and ceramic fragments will be quantified and photographed but will not be collected. Of course, if new classes of artifacts or other archaeological material are found, then appropriate collections of these materials will be made for laboratory analysis. This historic feature sampling will focus on recovering useful archaeological information without unnecessarily increasing the volume of redundant artifacts and faunal remains from the study area.

7.6.6 Photography

Photographs will be taken of the general project area and in-progress work, recording on-the-job procedures, personnel, work conditions, and the area's natural and/or built environment. Additionally, all subsurface features, cultural layers, profiles, and artifacts will be photographed. A photographic scale and north arrow, as appropriate, will be included in each photograph. Human skeletal remains will not be photographed, as it is illegal to photograph these remains without proper permission of the SHPD.

7.7 Laboratory Methods

Materials collected during AIS fieldwork will be identified and catalogued at CSH's laboratory facilities on O‘ahu. Analysis of collected materials will be undertaken using standard archaeological laboratory techniques. Artifacts will be washed, sorted, measured, weighed, described, photographed, and catalogued. In general, artifact analysis will focus on establishing, to the greatest extent possible, material type, function, cultural affiliation, and/or age of manufacture. Diagnostic (dateable) attributes of artifacts will be researched.

7.7.1 Traditional Hawaiian Artifacts

Traditional Hawaiian artifactual material will be identified, and forms and functions determined using standard reference material (e.g., Barrera and Kirch 1973; Brigham 1974; Buck 2003; and Emory et al. 1968).

7.7.2 Historic Artifacts

Historic artifacts will be identified using standard reference materials and resources available on the internet (e.g., Elliott and Gould 1988; Fike 1987; Kovel 1986; Lehner 1988; Lindsey 2010; Lockhart 2004-2010; Millar 1988; Toulouse 1971; Whitten 2009; and Zumwalt 1980). Analyzed materials will be tabulated into chart form and a master catalogue will be presented within the AIS report.

7.7.3 Bulk Sediment Samples

To provide additional information on the content of selected sediments, the collected bulk sediment samples (varying from 1 to 5 liters) will be wet screened through 1/16-inch mesh. The remnant will be dried and inspected for faunal, floral, and artifact remains. These results will be included in the description of the sediment. (Note: many bulk sediment samples will likely be collected from the same stratum or feature of a test trench; some of these redundant samples may not necessarily be wet-screened in this manner if the need for further investigation is not indicated.)

7.7.4 Vertebrate Material

Non-human skeletal material will be identified to the lowest possible taxa at the CSH laboratory using an in-house comparative collection and reference texts (e.g., Olsen 1964; Schmid 1972; and Sisson 1953). If a large number of bird or fish bones (or any unusual bones) are recovered, they will be submitted to an expert in faunal analysis for identification.

7.7.5 Invertebrate Material

Invertebrate remains will be identified to genus and species, weighed, and analyzed. Common marine shells will be identified and analyzed at the CSH laboratory using an in-house comparative collection and reference texts (e.g., Abbott and Dance 1990; Eisenberg 1981; Kay 1979; and Titcomb 1979). If any rare and/or extinct marine or freshwater shells are recovered, an outside expert will be consulted for identification of the material.

7.7.6 Wood Taxa Identification

Appropriate charcoal samples will be prepared, weighed, and submitted for species identification. Samples will be sent to the International Archaeological Research Institute, Inc. (IARII) for taxa identification. The samples will be viewed under magnification of a dissecting microscope and then compared with anatomical characteristics of known woods in the Pacific Islands Wood Collection at the Department of Botany, University of Hawai‘i, as well as published descriptions. Taxa identification of wood samples provides useful information for interpreting the environmental and cultural history of the project area and helps determine a general time frame of land use. Analysis by IARII also will identify short-lived plant species,

which will be used for radiocarbon dating. Following analysis, artifacts will be returned to the CSH laboratory.

7.7.7 Radiocarbon Dating

Charcoal samples from short-lived plant species will be submitted to Beta Analytic, Inc. of Miami, Florida, for radiocarbon dating analysis. The samples will be analyzed using the Accelerator Mass Spectrometer method. The conventional radiocarbon age determined by Beta Analytic, Inc. then will be calibrated to calendar ages using the OxCal calibration program, Version 4.1, developed by the University of Oxford Radiocarbon Accelerator Unit and available as share-ware over the internet. The use of short-lived plant species is preferred as it provides a tighter time-frame of possible radiocarbon dates. CSH anticipates up to 30 carbon samples will be submitted for dating analysis.

7.7.8 EDXRF Analysis

Samples may be sent to the X-Ray Fluorescence (XRF) Lab at the University of Hawai‘i-Hilo for Energy-Dispersive X-Ray Fluorescence (EDXRF) analysis. EDXRF analysis is an effective way to determine elemental composition of archaeological material, for example basalt artifacts or volcanic glass, and in some instances by using a comparative database the origin of the material can be determined. X-ray spectrometry emissions produce an energy spectrum that is observable as peaks of high and low concentrations of trace elements. These trace elements are measured as value ranges. These value ranges are compared to other known value sets and to a constant geological standard (BHVO-2) used as the control sample. Samples are analyzed non-destructively with an accuracy of less than 1 percent of relative error and comparable reproducibility (Shackley 2010). Following analysis, artifacts will be returned to the CSH laboratory.

7.7.9 Pollen/Micro Charcoal Particle Analysis

Palynology is the branch of science concerned with the study of pollen, spores, phytoliths, and other palynomorphs. Palynomorphs are often preserved in sediment samples and, following physical and chemical extraction, can be identified with a microscope. This information informs on the types of plants that made up the local environment, or the local watershed, at the time the sediment was deposited. A large amount of palynological research has been conducted on O‘ahu to examine human impacts on native vegetation. Micro charcoal particle quantification will accompany the palynological work. The size and amount of these charcoal particles within a sediment sample can inform on the level of human activity in the vicinity at the time the sediment was deposited. CSH anticipates up to 24 samples will be submitted to Paleo Research Institute, Inc. for pollen analysis/micro charcoal particle quantification to facilitate paleo-environmental reconstruction. Samples for these analyses will be selected from the collected bulk sediment and sediment column samples that are collected from AIS trenches.

7.8 AIS Report

7.8.1 Report Contents

The AIS report will include the following:

a. A project description
b. A section of a U.S. Geological Survey topographic map showing the study area boundaries and the location of all recorded cultural resources
c. Historical and archaeological background sections summarizing pre-contact and post-contact land use of the study area and its vicinity
d. Descriptions of all cultural resources, including selected photographs and scale drawings, and discussions of age, function, laboratory results, and significance
e. If appropriate, a section concerning cultural consultations (per the requirements of HAR 13-276-5[g] and HAR 13-275/284-8[a][2])
f. A summary of cultural resource categories, integrity, and significance based upon the National and Hawai‘i Registers of Historic Places evaluation criteria
g. A project effect recommendation
h. Treatment recommendations to mitigate the Project’s potential effect on any cultural resources identified in the study area that are recommended eligible to the National/Hawai‘i Registers of Historic Places

7.8.2 Cultural Resource Numbers and Feature Designations

CSH will assign SIHP numbers to archaeological features observed during the AIS. This may include documenting previously unrecorded sites/features and assigning them new SIHP numbers or documenting additional features of an already existing cultural resource (in which an SIHP number has already been assigned).

Different features will be included within the same archaeological site based on several considerations, including: 1) general geographic proximity (features closer together are more likely to be included within the same site number than those farther apart); 2) similarity of features; and/or 3) interrelatedness of features (e.g., subsurface features of a continuous subsurface cultural layer). Horizontal boundaries of cultural resources will be documented to the extent possible.

7.8.3 Cultural Resource Significance Assessments

To be considered eligible for listing on the Hawai‘i and/or National Register of Historic Places a cultural resource must possess integrity of location, design, setting, materials, workmanship, feeling, and association, and meet one or more of the following broad cultural/historic significance criteria: “A” reflects major trends or events in the history of the state or nation; “B” is associated with the lives of persons significant in our past; “C” is an excellent example of a site type/work of a master; “D” has yielded or may be likely to yield information important in prehistory or history; and, “E” (Hawai‘i Register only) has traditional cultural significance to an ethnic group, includes religious structures, traditional cultural properties, and/or burials. For this AIS investigation, cultural resource integrity and significance will be assessed based on the guidance provided in National Register Bulletin # 15, “How to Apply the National Register Criteria for Evaluation.” Cultural resource integrity and significance assessments will be developed in consultation with the SHPD.

7.9 Disposition of Collections

In compliance with the Project’s Programmatic Agreement, Stipulation III.F “Curation,” the City will curate recovered materials in accordance with applicable laws, including HAR Chapter 13-278 and 36 C.F.R. 79. The City is currently developing a curation program and seeking a curation facility that will meet these requirements. Until these curation measures are in place, all collected materials and associated records generated by the Airport Phase 3 Section AIS fieldwork will be temporarily curated either at CSH’s temporary field office specific to the Airport Phase 3 Section AIS or at CSH’s main O‘ahu office in Waimānalo.

In the event that human remains are encountered, the temporary disposition of human skeletal remains and associated burial goods will be determined by the SHPD Burials Program in consultation with the City. Because Federal lands are part of the Airport Phase 3 Section AIS study area, Federal Native American Graves and Repatriation Act regulations will apply. The treatment and final disposition of AIS identified burials and/or human skeletal remains will follow Hawai‘i State Burial Law (HRS Chapter 6E-43 and HAR Chapter 13-300).